View metadata, citation and similar papers at core.ac.uk

brought to you by CORE

provided by DigitalCommons@University of Nebraska

University of Nebraska - Lincoln
DigitalCommons@University of Nebraska - Lincoln

Roman L. Hruska U.S. Meat Animal Research Center

U.S. Department of Agriculture: Agricultural Research Service, Lincoln, Nebraska

1993

Evaluation of Four Computer Models for Prediction of Growth and Body Composition

Gary L. Bennett
U.S. Meat Animal Research Center, gary.bennett@ars.usda.gov

Ralph N. Arnold
Production Systems Research Unit, U.S. Meat Animal Research Center

Follow this and additional works at: http://digitalcommons.unl.edu/hruskareports

Bennett, Gary L. and Arnold, Ralph N., "Evaluation of Four Computer Models for Prediction of Growth and Body Composition" (1993). *Roman L. Hruska U.S. Meat Animal Research Center*. 335.
http://digitalcommons.unl.edu/hruskareports/335

This Article is brought to you for free and open access by the U.S. Department of Agriculture: Agricultural Research Service, Lincoln, Nebraska at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in Roman L. Hruska U.S. Meat Animal Research Center by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.

Evaluation of Four Computer Models for Prediction of Growth and Body Composition

Gary L. Bennett and Ralph N. Arnold[1,2]

Introduction

Leaner, high quality beef can be produced by making good management and genetic decisions. The problem is knowing what is a good decision. Computer models can be used to predict the outcomes of different ways of producing beef. Managers can choose their best system using these predictions combined with their financial and feed resource information.

Several computer models predict growth and body composition as part of an overall evaluation of beef production. Other models predict only growth and body composition. These models predict one or more of the following biological processes: the amount of feed consumed, the partition of consumed feed into nutrients for maintenance and growth, and the partition of nutrients used for growth into fat, lean, and bone.

This research compared growth and body composition prediction from four computer models. Standard situations and experimental results were used for the comparison. The goal was to decide whether any of the models were accurate enough to aid cattle producers who want to increase the leanness of beef. Another goal was to find ways to improve predictions.

Procedure

Three computer models of growth and body composition were extracted from models of overall beef production systems. The developers of these models emphasized feed intake and growth more than body composition. The fourth model evaluated was developed to predict growth and composition when feed intake was known. The four models were then used to make comparisons.

The standard situations compared were lean growth unrestricted by feed intake, forage diet, grain diet, compensatory growth, and medium and large size steers. Feed intake of forage and grain diets was determined several ways, i.e., using model predictions, using the same intake for all models, and as a percentage of body weight.

Three experiments were identified that had both feed intake and body composition available for comparison with model predictions. The experimental treatments included level of feed intake, type of feed, breed, age, and sex. Both actual feed intake and predicted feed intake were used for some comparisons.

Results

The computer models required either direct input of mature wt or other indirect input values that resulted in a mature weight. Direct or indirect input values for mature wt were adjusted so that protein growth rates were the same for the first 900 days following birth assuming growth was not restricted by feed intake. Fat growth rates were similar for all models until about 500 days and then diverged as animals approached maturity.

The four models responded differently to different levels of assumed feed intake. Models also differed when all-grain diets were compared with all-forage diets. Simulated body composition varied with level of feed in three models but only after severe restriction in another model. Two models simulated slight compensatory growth. The predicted effect of 200 days of restricted growth followed by ad lib intake ranged from 0 to 5% body fat at slaughter weight.

Differences among model predictions stemmed from assumptions about feed intake, maintenance requirements, protein:water ratios, and the partition of growth among different tissues. These were the result of differences in the interpretation of the growth process. Equalizing feed intake reduced differences in growth and composition when grain was fed but not when poor quality roughage was fed.

It was apparent from the simulation of standard situations that the evaluation of a beef production system will depend on the computer model chosen, especially if carcass composition is important. Comparisons with experimental results were done to find which situations were accurately predicted by the computer models.

Many predicted and experimental wt differed by more than would be expected by chance. Differences expressed as percentages of their experimental values were generally less for body wt than for fat, water, and protein weight. The accuracy of predicting fat was usually less than protein and water.

Predicted and experimental feed intakes for ad lib treatments were also different in many cases. There was a tendency to over- or underpredict intake for all treatments in an experiment, but this was not always the case.

A consistent pattern of differences, such as finding differences only in one type of cattle or for one kind of feed, was not apparent. This limited conclusions about how to improve the models. Weight gain was more accurately predicted than the composition of the gain. This suggests that more research is needed to determine the partition of gain to fat, lean, and bone. One conclusion reached was that when fat was considered to result from the storage of excess energy, then all errors in predicting feed intake and its utilization for maintenance and growth end up as differences in fat.

These comparisons suggested that other approaches to predicting the effects of nutrition on body composition need to be tried. To be useful in designing and evaluating systems of producing leaner beef, these approaches need to have fewer places where errors can occur or distribute errors more evenly among lean, fat, and bone.

---

[1]Bennett is the research leader and Arnold was a research affiliate, Production Systems Research Unit, MARC.

[2]The full report of this work was published in Agricultural Systems 35:401-432 and 36:17-41, 1991.